presented by Dr. Weinek; photographs of *Orion*, the Milky Way, &c. (negative, lantern slides, and enlargements), presented by Dr. Sheldon; lantern slide from negative of the Cluster in *Hercules*, presented by W. E. Wilson.

Answer to an Inquiry in the "Bulletin Astronomique" for May 1895, *p.* 233. By E. J. Stone, M.A., F.R.S., Radcliffe Observer.

In the *Bulletin Astronomique* for May 1895 there is a short notice of my paper, "On Some Points connected with the Integration of the Differential Equations of the Relative Motions of Material Systems" (which appeared in the *Monthly Notices* for 1894 June), which very clearly and concisely states the fundamental point of my paper to be the unchangeableness of the fundamental constant, *f*; but adds: "Il serait à désirer que M. Stone formulât d'une manière nette et précise les critiques qu'il sous-entend en parlant de conditions incompatibles entre la variable représentant le temps et les observations."

I have no difficulty in answering this very reasonable request.

If we denote the geocentric co-ordinates of the Sun under the usual forms

$$2\pi\iota + \odot = l + nt + \lambda t^2 \text{ \&c.} + \int \mathrm{A} \sin(\alpha t + \beta),$$

$$\frac{1}{r} = \text{\&c.}$$

$$\beta = \text{\&c.}$$

where $\int$ denotes a definite number of periodical terms, then in the mathematical investigations of the disturbances of the elliptic motions the effects of all the terms in the geocentric co-ordinates of the Sun, including those which are themselves due to planetary and lunar disturbance, are duly investigated subject to the condition

$$\delta[n(t+\tau)] = 0,$$

or, with *exact* values of *t* and a definite epoch,

$$\delta n(t+\tau) = 0,$$

and included in the different theoretical expressions of the geocentric co-ordinates of the Moon and planets.

If any long inequality,

$$\mathrm{P} \,.\, \sin(pt + q),$$

has been omitted in the expressions for $\odot$, $\frac{1}{r}$, and β, the theoretical determination of the disturbing effects cannot be regarded as complete until those due to this term have been investigated, and, if found sensible, included in the theoretical expressions of the Moon and planets.

The resulting theoretical expressions for the geocentric coordinates of the Moon and of the planets can thus be made complete; but they will only be exact when the conditions under which they have been mathematically investigated are fulfilled; and the condition $\delta n\ (t+\tau)$ requires that the variable t, with which the theoretical expressions are compared with observation, should satisfy the condition

$$(1) \quad . \quad . \quad . \quad . \quad 2\pi\iota + \odot = n\tau + nt + \lambda t^2 + \mathrm{P}\ .\ \sin\ (pt+q) + \int \mathrm{A}\ \sin\ (\alpha t + \beta)$$

with the value of n, which is used to fix the numerical value of f, or to eliminate that symbol from the mathematical formulæ, and the value of $\tau = \frac{l}{n}$ which has been used to render definite the instant from which t is measured.

But if the theoretical expressions of the geocentric coordinates of the centres of gravity are expressed as functions of the variable t, which satisfies the equation (1) with assigned values of l and n, we must express the right ascensions of the meridians as functions of the same variable; and if α is the right ascension of an observer's meridian, we shall have

$$(2) \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad 2\pi\iota + \alpha = \mathrm{A} + \Omega t + \sigma t^2 + \mathrm{N}ut.$$

where A and Ω are constants which cannot be found except from a discussion of observations. The values of A and Ω, which will for a definite meridian correspond to assigned values l and n in the equation (1), can only be approximately assigned at the present time. But they will be expressible under the forms

$$\mathrm{A} = l + \delta l. \qquad \Omega = \left(\frac{2\pi}{\mathrm{N}o} + 1\right) n,$$

where δl and $\mathrm{N}o$ are unknown quantities, to be found from the discussion of observations; and we can, if we please, put

$$\mathrm{N}o = \frac{n + \delta n}{365{\cdot}25}.$$

We have then to find the quantities δl and δn from a discussion of the observations.

But if we neglect the terms δl and δn in the equations

$$(3) \quad . \quad . \quad . \quad 2\pi\iota + \alpha = l + \delta l + \left(\frac{2\pi \times 365{\cdot}25}{n + \delta n} + 1\right) nt + \sigma t^2 + \mathrm{N}ut.$$

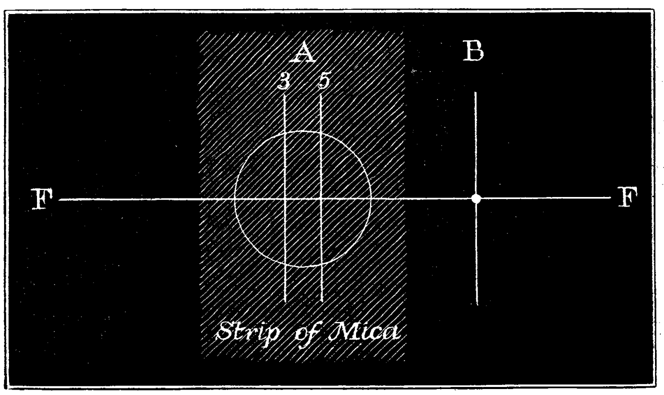
in comparing the results of theory with observations, either directly or in finding the value of the variable from the observed right ascensions, we, at once, by the neglect of the terms δl and δn, introduce between the facts of observation, α, and the variable t, employed in the theoretical investigations, impossible conditions; and these are the incompatible conditions between the variable representing the time and the observations to which I refer.

Micrometer Measurements of Phobos, the Inner Satellite of Mars, during the Opposition of 1894. By H. F. Newall, M.A.

The following measurements of the inner satellite of *Mars* were made during the opposition of 1894 with a filar micrometer on the 25-inch refractor of the Cambridge Observatory.

The satellite could on most occasions be seen with the planet in full sight in the field, but it was found to be easier to make the measurements when the main glare of the planet was subdued by a slip of mica, tolerably thickly blackened by smoke, fixed to the eyepiece in such a way that the mica was as close to the plane of the webs as possible consistently with safety to the webs. No illumination of the field or webs was used, the satellite being so close to the planet that there was enough light in the background to make the webs visible.

There are in the micrometer two frames, A and B, each carrying a set of webs, one moved by a screw A, the other by screw B. The measurements of distance were all made with the screw B. The value of one revolution has been taken as $5''\cdot911$*, determined from measurements of the separation (about $270''$) of two stars in the *Pleiades*, a provisional value of the separation being taken from Elkin's measurements.



The only webs on frame A with which we have here to do are two parallel webs, A_3 and A_5, separated by a fixed interval of about $8''$, and a fixed web, FF, which is parallel to the axes of the screws A and B, and perpendicular to A_3 and A_5. The middle point of the part of FF between A_3 and A_5 is moved by movements of the screw A and of the micrometer box on its slipping piece so as to be at the centre of the position circle. When this adjustment was completed, neither screw A nor the

* This value may require a slight alteration; it will be given when the sources of some curious discrepancies which have occurred between the results of determinations by different methods are more thoroughly understood. I am indebted to Professor Turner for his kindness in measuring a large number of photographs of the Pleiade with a view of giving a reliable value for the separation of the stars I used in one of my methods.